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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/835,498 | 04/16/2001 | Ki Young Oh | P/2292-43 | 5377 |

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| EXAMINER | |
|---|---|
| SONG, MATTHEW J | |
| **ART UNIT** | **PAPER NUMBER** |
| 1765 | |

DATE MAILED: 09/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/835,498 | OH ET AL. | |
| | Examiner | Art Unit | |
| | Matthew J Song | 1765 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *18 June 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-3* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/18/2004 has been entered.

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan et al (US 5,879,574) in view of Nishizawa et al (US 6,464,793), Tsuchimoto (US 3,916,034) and Powell et al (US 6,287,643).

Sivaramakrishnan et al discloses a Chemical vapor deposition (CVD) apparatus includes a susceptor **25** installed inside the reactive chamber, a heater/lift assembly **30** and a remote microwave plasma system **55** to deposit plasma enhanced CVD films by inputting deposition reactive gases into system **55** via input line **57** (col 14, ln 20-25). Sivaramakrishnan et al also discloses for plasma processes the CVD apparatus will include a gas feed-through box housing gas passages **83**, **85** to enable the application of high voltage RF power to the gas box (col 26, ln 40-45). Sivaramakrishnan et al also discloses a vacuum pump is activated to generate vacuum pressure within a pumping channel, thereby drawing the process gases and plasma residue out of the processing chamber through a exhaust port **361** (col 35, ln 33-37 and Fig 4 and 8), where the exhaust port reads on applicant's gas outlet. Sivaramakrishnan et al also discloses exhausting gas through an exhaust line by a vacuum pump (col 13, ln 45-55), this reads on applicants' vacuum pump connected to the gas outlet. Sivaramakrishnan et al also discloses a process selector subroutine **153** identifies the desired set of process parameters needed to operate the process chamber, where the process parameters include process gas composition and flow rates, temperature, pressure, plasma composition and chamber wall temperature (Fig 1D and col 17, ln 20-35). Sivaramakrishnan et al discloses a process gas control subroutine **163** for controlling the process gas composition and flow rates, which reads on applicant's gas supply controller (col 18, ln 50-67) and heat control subroutine **167** for controlling the temperature (col 19, ln 58-67),

which reads on applicant's temperature controller. Sivaramakrishnan et al also teaches a chamber with a ceiling (Fig 1A).

Sivaramakrishnan et al does not disclose at least two gas supply controllers respectively installed at the gas supply pipes to supply the material gases alternately into the chamber.

In a semiconductor crystal growth apparatus, note entire reference, Nishizawa et al teaches a vessel **1** includes nozzles **4** and **5** for introducing gaseous compounds, where the nozzles **4** and **5** are provided with on-off valves **6** and **7** for controlling the introduced amounts of gaseous compounds. Nishizawa et al also teaches a control unit **18** controls the opening and closing of the valves **6** and **7** for alternately and repeatedly introducing gases (col 4-5 and Fig 3). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sivaramakrishnan et al with Nishizawa et al to grow an epitaxial layer having a desired thickness can be attained with precision as precise as a single molecular layer (col 4, ln 60-67) and to prevent undesired reactions between two or more source gases.

The combination of Sivaramakrishnan et al and Nishizawa et al does not disclose at least two remote plasma generators installed outside the reactive chamber.

In a method of transporting plasma to a substrate to grow a single crystal of material on a substrate, note entire reference, Tsuchimoto teaches two or more selected materials are turned into separate ionized plasmas in separate plasma generating chambers **1a** and **1b** (Abstract and Embodiment 2). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al and Nishizawa et al with Tsuchimoto because a plurality of materials, which cannot coexist in a single plasma generator, can be separately turned into the corresponding plasma (col 9, ln 1-67).

Referring to claim 1, the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto does not teach the plasma generators are for alternatively activating the material gases supplied through the gas supply pipes. This feature is an intended use of the two remote plasma generators installed outside the reactive chamber which are connected to the gas supply pipes. The two remote plasma generators are taught by the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto; therefore would be capable of performing the claimed intended use. Also, the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto does not teach at least two gas supply pipes for supplying at least two material gases into the reactive chamber in a manner that it suited to form an ultra-thin atomic film. The feature is an intended use of the two gas supply pipes. The combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto teaches two supply pipes, which would be capable of performing the claimed intended use. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). The combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto teaches the structure claimed by applicant, which would be capable of performing the claimed intended use. Also, the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto does not teach the apparatus is an atomic layer deposition apparatus. This limitation is also an intended use of the apparatus. The combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto teaches all of the structural limitations of claim 1, as discussed previously, therefore the apparatus taught by the combination of

Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto would be capable of operating as an atomic layer deposition apparatus.

Referring to claim 3, the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto teaches a heater/lift assembly **30**.

3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan et al (US 5,879,574) in view of Nishizawa et al (US 6,464,793), and Tsuchimoto (US 3,916,034) as applied to claim 1 above, and further in view of Amano et al (US 5,948,485).

The combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto teaches all of the limitations of claim 2, except a grounding unit connected to the upper container and lower container to clean the inside of the chamber and a RF power generator connected to the susceptor to apply an RF power to the susceptor.

In an apparatus for plasma deposition, Amano et al teaches a plasma process apparatus includes a container **2** divided into two parts, a plasma chamber **21** and a reaction chamber **22**, where the vacuum container **2** is grounded at zero potential. Amano et al also teaches aluminum stage **52** for use as a susceptor and the stage is connected with a radio-frequency power supply unit **61** for plasma lead-in through a blocking capacitor. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al, Nishizawa et al, and Tsuchimoto with Amano's susceptor connected with a radio-frequency power supply because ions are confined to the target object on the susceptor (col 5, ln 1-10). Also it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Sivaramakrishnan et al, Nishizawa et

al, and Tsuchimoto with Amano's grounded container because it protects the integrity of the chamber and the chamber circuitry from any static discharge or induced electrical currents that may build in or on the chamber.

***Response to Arguments***

4. Applicant's arguments with respect to claims 1-3 have been considered but are moot in view of the new ground(s) of rejection.

5. Applicant's arguments filed 6/18/2004 have been fully considered but they are not persuasive.

In response to applicant's argument that a gas supply and the controllers which operate it, from an ultra-thin film on the substrate, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). The gas controllers taught by the prior art are capable of alternately injecting reactant gases to form an ultra-thin film; therefore there is no structural distinction between the prior art structure and the instantly claimed invention. Furthermore, Sneh et al (US 6,503,330) teaches atomic layer deposition by merely opening and closing valves to supply gases alternately.

Therefore, since the prior art teaches valves connected to reactive gas sources, which are capable of performing the claimed atomic layer deposition process.

***Conclusion***

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Solomon et al (US 6,179,913) teaches a compound nozzle **33**, where an outlet **34b** is completely encircled by an outlet **32b** and the outlet **34b** is coaxial with outlet **32b** (col 4, ln 55-67 and Figs 2-4).

Lopatin et al (US 6,538,327) teaches an ALD process is performed using a chemical vapor deposition tool (col 4, ln 40-50).

Sneh et al (US 6,503,330) teaches valves **42, 43** are opened and closed to alternately supply a first and second precursor alternately to perform an ALD cycle (col 10, ln 25-60).

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER